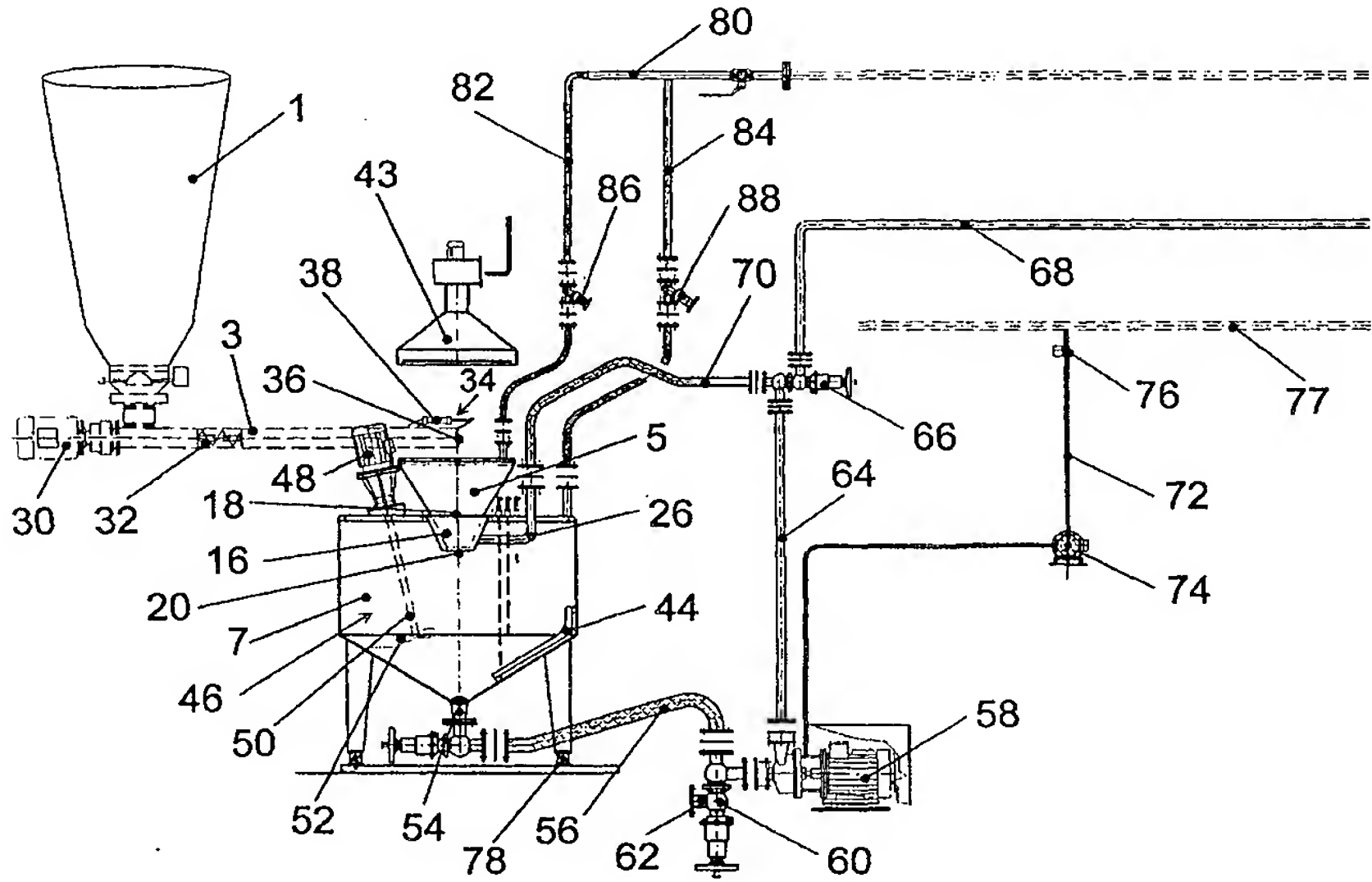


## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification <sup>7</sup> : <b>B01F 5/00, D06B 23/20</b></p>	<p><b>A1</b></p>	<p>(11) International Publication Number: <b>WO 00/56432</b></p> <p>(43) International Publication Date: 28 September 2000 (28.09.00)</p>		
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top; padding: 5px;"> <p>(21) International Application Number: PCT/IT99/00348</p> <p>(22) International Filing Date: 2 November 1999 (02.11.99)</p> <p>(30) Priority Data: TO99A000211 19 March 1999 (19.03.99) IT</p> <p>(71) Applicant (for all designated States except US): TERMOELETTRONICA S.P.A. [IT/IT]; Via Petrarca 10, I-24052 Azzano S. Paolo (IT).</p> <p>(72) Inventor; and (75) Inventor/Applicant (for US only): PESENTI, Giorgio [IT/IT]; Via Lotto, 19, I-24010 Ponteranica (IT).</p> <p>(74) Agent: GARAVELLI, Paolo; A.Bre.Mar. S.r.l., Via Servais, 27, I-10146 Torino (IT).</p> </td> <td style="width: 50%; vertical-align: top; padding: 5px;"> <p>(81) Designated States: AE, AL, AU, BA, BB, BG, BR, CA, CN, CU, CZ, EE, GD, GE, HR, HU, ID, IL, IN, IS, JP, KP, KR, LC, LK, LR, LT, LV, MD, MG, MK, MN, MX, NZ, PL, RO, SD, SG, SI, SK, TR, TT, UA, US, VN, YU, ZA, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).</p> <p><b>Published</b> With international search report.</p> </td> </tr> </table>			<p>(21) International Application Number: PCT/IT99/00348</p> <p>(22) International Filing Date: 2 November 1999 (02.11.99)</p> <p>(30) Priority Data: TO99A000211 19 March 1999 (19.03.99) IT</p> <p>(71) Applicant (for all designated States except US): TERMOELETTRONICA S.P.A. [IT/IT]; Via Petrarca 10, I-24052 Azzano S. Paolo (IT).</p> <p>(72) Inventor; and (75) Inventor/Applicant (for US only): PESENTI, Giorgio [IT/IT]; Via Lotto, 19, I-24010 Ponteranica (IT).</p> <p>(74) Agent: GARAVELLI, Paolo; A.Bre.Mar. S.r.l., Via Servais, 27, I-10146 Torino (IT).</p>	<p>(81) Designated States: AE, AL, AU, BA, BB, BG, BR, CA, CN, CU, CZ, EE, GD, GE, HR, HU, ID, IL, IN, IS, JP, KP, KR, LC, LK, LR, LT, LV, MD, MG, MK, MN, MX, NZ, PL, RO, SD, SG, SI, SK, TR, TT, UA, US, VN, YU, ZA, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).</p> <p><b>Published</b> With international search report.</p>
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<p>(54) Title: DEVICE FOR SUSPENDING SUBSTANCES IN A LIQUID, AND SYSTEM FOR PREPARING LIQUID-SUBSTANCES MIXTURES FOR DYEING USING SUCH DEVICE</p>				
				
<p>(57) Abstract</p> <p>A system is disclosed for preparing mixtures of liquid-substances for dyeing, comprising: substances storing means (1); at least one vessel (7) to dissolve the substances in the liquid; hydraulic means (77, 80, 82, 84, 86, 88) to supply hot and cold water to the vessel (7); hydraulic means (56, 58, 60, 64, 66, 68, 70) to send the substances+liquid mixture to downstream distribution systems; and a device (16) for suspending substances in a liquid on the vessel (7) downstream of the funnel (5). The device (16) internally receives substances and liquid, and realizes a swirling motion of the liquid inside which the substances are suspended and unloaded.</p>				

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DEVICE FOR SUSPENDING SUBSTANCES IN A LIQUID, AND  
SYSTEM FOR PREPARING LIQUID-SUBSTANCES MIXTURES FOR  
DYEING USING SUCH DEVICE

The present invention refers to a device for suspending substances in a liquid, and to a system for preparing liquid-substances mixtures for dyeing using such device.

In the field of fabric dyeing, it is common practice to use a mixture of substances and liquid for dyeing operations. The liquid being used is usually water, while as regards the substances, various types and compounds are employed, according to the type of application, but the major part in this case is composed of salt (NaCl). Hereinbelow, the text of the present invention will deal with the particular case of water and salt, but it is intended that, respectively, liquids and substances of any type that are commonly used in dyeing fabrics, fall within the scope of the present invention.

Salt, due to its hygroscopic features, has

great problems when it is used in dyeing systems. In particular, these problems are related to its scarce mixing capability in water, so that it has been computed that salt being present in a saturated solution does not exceed 33% in its composition. Therefore, to use the very high amounts of salt required in dyeing plants, it would be necessary, to transport them, to use an amount of water that is double with respect to the amount of salt, amount that cannot be contained inside the dyeing equipment. Therefore, to be able to make salt arrive to the distribution systems in a dyeing plant, in many cases it is necessary to manually unload it from the bags containing it, which operation is costly and unfeasible when very high production volumes are present.

Another proposed solution is the one shown in Fig. 1, wherein one or more (in this case two) silos 1 are provided to contain salt (or other types of substances) that periodically unload a preset amount of salt, through ducts 3, into a collection funnel 5, that in turn makes salt penetrate into a mixing vessel 7. In practice, the ducts 3 can be connected to the vessel 7 in various ways and at different heights, sometimes not using

the funnel 5. From the vessel 7 the water+salt mixture is pumped through a pump 9 and ducts 11 to a distributor 13 to be sent to the dyeing plant through further ducts 15. A system of this type has still many problems, since salt unloaded into the vessel 7 is not completely mixed with water being present therein and soon forms compact heaps on the bottom of the vessel 7 itself, with following dangers of clogging the ducts and with great, and sometimes unsolvable, difficulties when the downstream supply has to be guaranteed.

Object of the present invention is providing a system that solves the prior-art problems, being equipped with a device that realizes the perfect suspension of salt (or other substances) in water (or other liquids), allowing it to be easily transported to downstream distribution systems, in the amounts required for dyeing plant workings and without duct clogging problems.

A further object of the present invention is providing a system that allows an easy cleaning of the duct from the remaining salt being present therein, by using components that are already present to transport working mixtures.

The above and other objects and advantages of

the invention, as will appear from the following description, are obtained by a device and a system as respectively claimed in Claims 1 and 8. Preferred embodiments and non-trivial variations of the present invention are claimed in the dependent Claims.

The present invention will be better described by some preferred embodiments thereof, given as a non-limiting example, with reference to the enclosed drawings, in which:

- Figure 1 is a perspective view of a prior-art system to which the device of the present invention can be applied;
- Figure 2 is a schematic side view of the system of the present invention equipped with the inventive device;
- Figure 3 is a top view of the substance-collecting funnel;
- Figure 4 is a front view of the funnel in Fig. 3;
- Figure 5 is a side view from a first perspective of the device for suspending substances in water according to the present invention;

- Figure 6 is a side view from a second perspective of the device in Fig. 5; and
- Figure 7 is a bottom view of the device in Fig. 5.

Even if the device 16 of the present invention can be used equally well and efficiently with the previously-described system with reference to Fig. 1, its application to the system shown in Fig. 2 will be described in detail. In any case, as clearly appears from the detailed views in Figs 5 to 7, the device 16 of the invention allows realizing in a simple and efficient way the suspension of salt in water, and therefore the mixture of salt itself with water before salt penetrates into the dissolving vessel 7. The device 16, in the preferred embodiment, is shown as an "overturnd" pipe of the Venturi type, with an inlet 18 whose shape is circular and an outlet 20 whose shape is also circular, but whose section is much lower than the inlet 18 section. Inlet 18 and outlet 20 are mutually connected by slanted walls 22, that complete the funnel-shape of the device 16. Finally, in an adequate way, the device 16 is equipped with at least one, and preferably a plurality of transverse slits 24 (Fig. 6) that

provide it with an air venting route. The thereby-arranged device 16 is placed immediately downstream of salt inlet funnel 5, as will be better described below, and is connected to a water supply pipe 26, placed in such a way that the water is immediately subjected to a swirling motion when it enters the device 16 and is mixed therein with salt. In this way, salt is put in suspension in water, that is, salt is in a way "pre-dissolved" before entering the real dissolving vessel 7; under this condition, with salt dissolved in water with a swirling motion, whose speed and whose rotation radius increase when going out of the device 16 and when entering the vessel 7, the supply is allowed of a water+salt mixture to the downstream distribution devices (not shown) in amounts that are much greater than those that can be obtained with prior-art systems, thereby arriving also at a mixture comprising 50% of salt in 50% of water.

With reference to Fig. 2, a preferred embodiment of the system for preparing the substances-liquid (in particular salt-water) mixture of the present invention will then be described in greater detail. Obviously, people skilled in the art could perform numerous

variations and improving integrations to the approximate diagram shown in Fig. 2, keeping untouched the basic functionalities claimed therein, so that such variation and integrations fall within the scope of the present invention, as defined by the enclosed claims.

The system schematically shown in Fig. 2 is equipped upstream with substances-storage means 1 (like the silos shown in Fig. 1), connected through ducts 3 to the dissolving vessel 7. The ducts 3 are in practice hoppers controlled by motors 30 and equipped with pushing means 32 adapted to push salt towards the outlet 34, adequately closed by a plug 36 that can be operated through piston and cylinder means 38 to be opened and closed. The presence of the plug 36 is mandatory, since salt is being handled that, due to its hygroscopic characters that has been already mentioned, could easily clog the ducts 3 preventing the system from operating. When going out of the ducts 3, salt is unloaded into the collection funnel 5, as better shown in Fig.s 3 and 4. The collection funnel 5 is equipped with an inlet 39 whose shape is ellissoidal, in such a way as to collect the maximum available amount of salt, and an outlet 40 whose circular

section is much lower than the inlet 38 section; inlet 38 and outlet 40 are mutually connected by slanted walls 42. Above the funnel 5 a hood 43 is located to suck air and discharge it outside the system.

Immediately downstream of the funnel 5, the device 16 of the present invention is located, inside which water is inserted through the duct 26: the thereby-inserted water, due to the device 16 shaped as a Venturi pipe, immediately starts moving with a swirling motion and, when salt is unloaded therefrom from the funnel 5, it is immediately put in suspension in water and goes out of the outlet 20 from below in the form of a salt+water mixture in a swirling motion, that gets widening with an always increasing radius when it is inside the vessel 7, to which the device 16 is fixed and connected as output. The salt-water mixture comes in contact with a flow-breaking member 44 adapted to prevent the breakage of hydraulic system pumps, that would occur due to the swirling motion of the mixture itself. The mixture can be further stirred by stirring means 46 equipped with control motor 48, arm 50 and propeller 52, even if such stirring means 46 are not mandatory for the operation of the

system of the invention. Therefore, the mixture is collected at the output 54 of the vessel 7 and is made pass through the duct 56 and, through a pump 58 connected to a valve 60 adapted to also allow the air supply to the system through the pipe 62, is sent into the duct 64 to the three-way valve 66. This valve, suitably switched, finally allows the salt+water mixture to go into the duct 68 to be sent to the downstream distribution devices (not shown). The three-way valve 66 enables a path through the duct 70 that takes water from the pump 58 to the device 16 to create the swirling motion therein when preparing the mixture.

The system in Fig. 2 is further equipped with an hydraulic circuit 72 activated by pump means 74 and solenoid valves 76, connected to the duct 77 supplying cold water to the system, and adapted to re-balance the pressure of water being present in the system.

In a known way, the vessel 7 is also equipped with load celles 78 adapted to weigh, in one or more passes, water and salt loaded in the vessel 7, to realize the mixture established by the current working. An hydraulic circuit is finally present being composed of ducts 80, 82, 84 and valves 86,

88 to supply the funnel 5 and to discharge the final washing water of the funnel 5 from vessel 7.

Obviously, in a way that can be easily realized by skilled people in the art, the system shown in Fig. 2 is made completely automatic by arranging suitable commands and controls, both of the hardware type (sensors, actuators, etc.), and of the software type (control programs, etc.) that allow realizing the correct system operation in all its operations (loading of salt and/or other substances, and water in the desired proportions and weights according to applications, mixing salt and water, sending the mixture, washing the system, etc.) under the control of common microprocessor systems.

Some embodiments of the invention have been described, but obviously they are prone to further modifications and variations within the same inventive idea.

**CLAIMS**

1. Device (16) for suspending substances in a liquid to be used for dyeing, characterised in that said device (16) is adapted to receive thereinto a supply of substances and liquid, and is adapted to realize a swirling motion of the liquid inside which the substances are then suspended, said device (16) then unloading said suspensions of substances in a liquid outside it by keeping its swirling motion.
2. Device (16) according to Claim 1, characterised in that said device (16) is composed of an overturned jet pipe of the Venturi type.
3. Device (16) according to Claim 2, characterised in that an inlet (18) of said device (16) has a cross-section that is much greater than an outlet (20) of said device (16).
4. Device (16) according to Claim 3, characterised in that the inlet (18) and the outlet (20) of said device (16) are of a circular shape.
5. Device (16) according to Claim 2, characterised in that it is further equipped with at least one transverse slit (24) to vent air that sucks salt towards the inside.

6. Device (16) according to any one of the previous Claims, characterised in that the liquid supply inside said device (16) is activated before supplying the substances.
7. Device (16) according to any one of the previous Claims, characterised in that said substances are mostly composed of salt and said liquid is water.
8. System for preparing mixtures of liquid-substances for dyeing, substantially comprising: substances storing means (1); at least one vessel (7) in which substances are dissolved in the liquid, said vessel (7) being connected through ducts (3) and a loading funnel (5) to said storing means (1); hydraulic means (77, 80, 82, 84, 86, 88) to supply hot and cold water to said vessel (7); and hydraulic means (56, 58, 60, 64, 66, 68, 70) to send the substances+liquid mixture to downstream distribution systems; characterised in that it is equipped with a device (16) for suspending substances in a liquid according to any one of Claims 1 to 7, said device (16) being placed on said vessel (7) immediately downstream of said loading

funnel (5).

9. System according to Claim 8, characterised in that said hydraulic means (56, 58, 60, 64, 66, 68, 70) sending the mixture are adapted to also perform a water ricirculation in said vessel (7) in order to wash and clean said vessel (7) and the ducts (56, 64, 68, 70) from said substances.
10. System according to Claim 9, characterised in that said hydraulic means (56, 58, 60, 64, 66, 68, 70) use valve means (66) to switch between said mixture sending operation and said washing and cleaning operation.
11. System according to any one of Claims 8 to 10, characterised in that is it further equipped with an hydraulic circuit (72) activated by pump means (74) and solenoid valves (76) adapted to re-balance the pressure of water being present in the system.
12. System according to any one of Claims 8 to 11, characterised in that it is further equipped with motored stirring means (46) with propeller (52) adapted to keep the substances+liquid mixture in a further swirling motion.
13. System according to any one of Claims 8 to 12,

characterised in that it is further equipped with at least one flow-breaking member (44) adapted to prevent the breakage of system pumps for the swirling mixture motion.

14. System according to any one of Claims 8 to 13, characterised in that it is further equipped with hydraulic means (80, 82, 84, 86, 88) adapted to perform the final washing with water of said funnel (5).
15. System according to any one of Claims 8 to 14, characterised in that said substances are mostly composed of salt and said liquid is water.

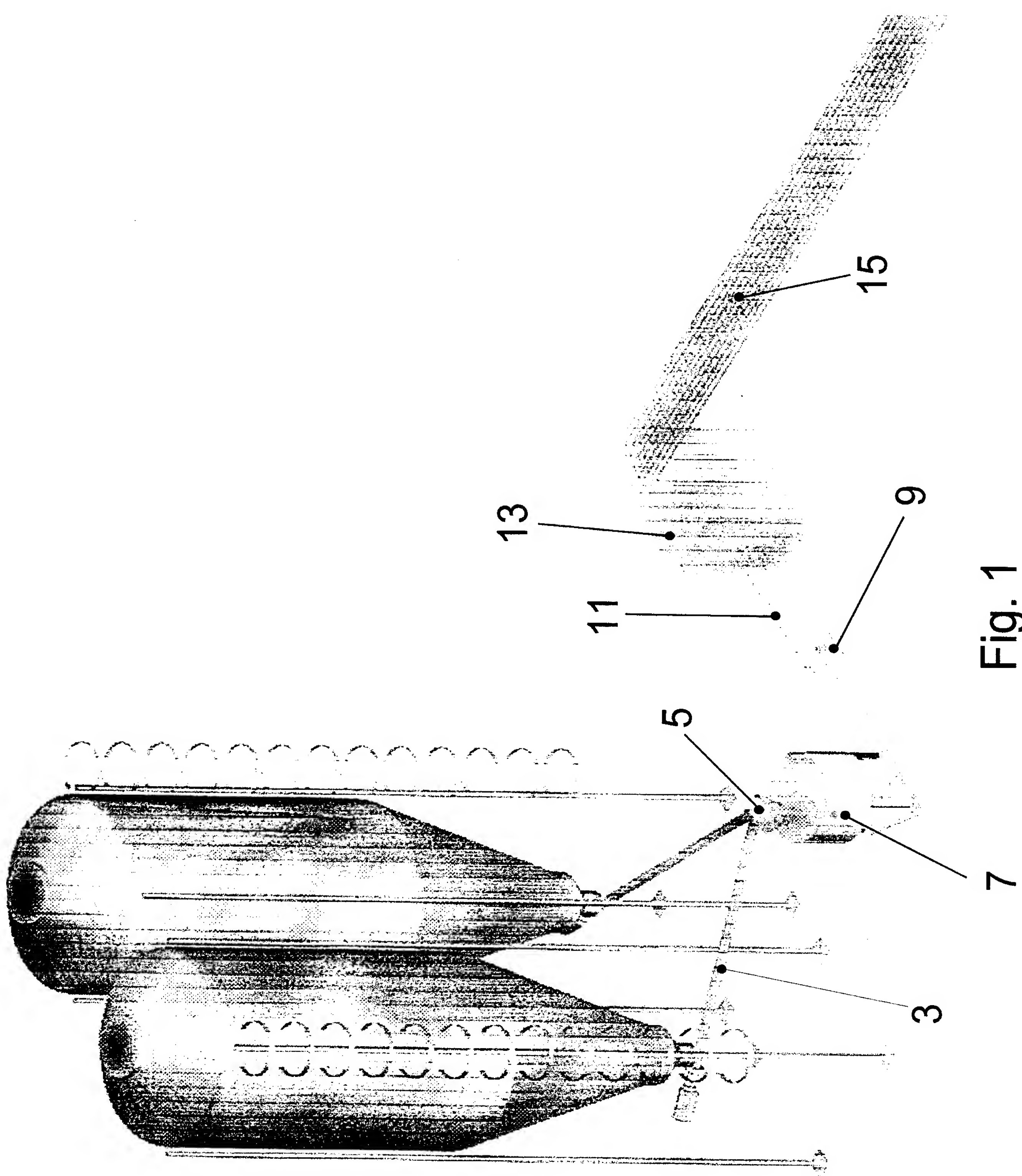


Fig. 1

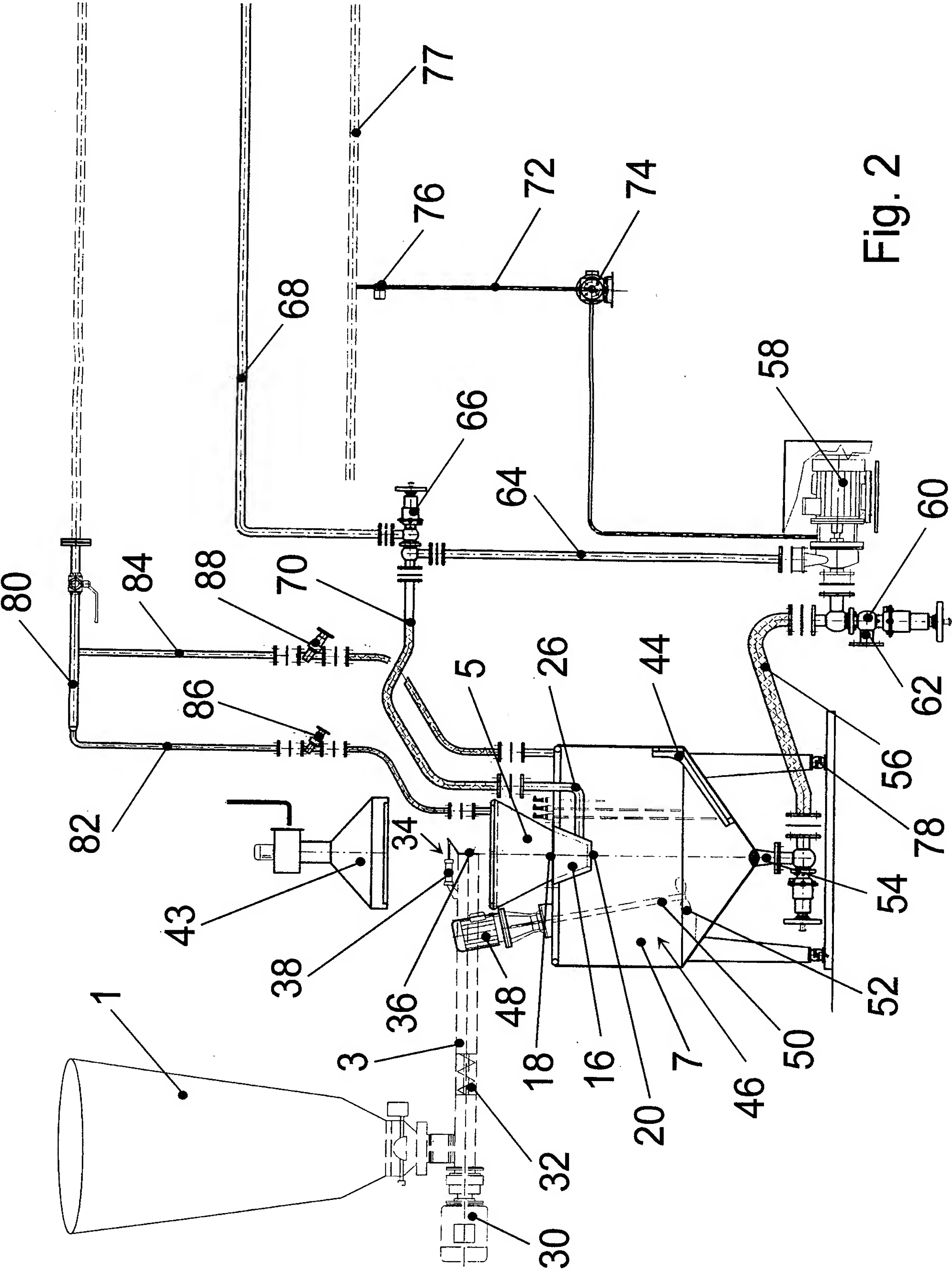


Fig. 2

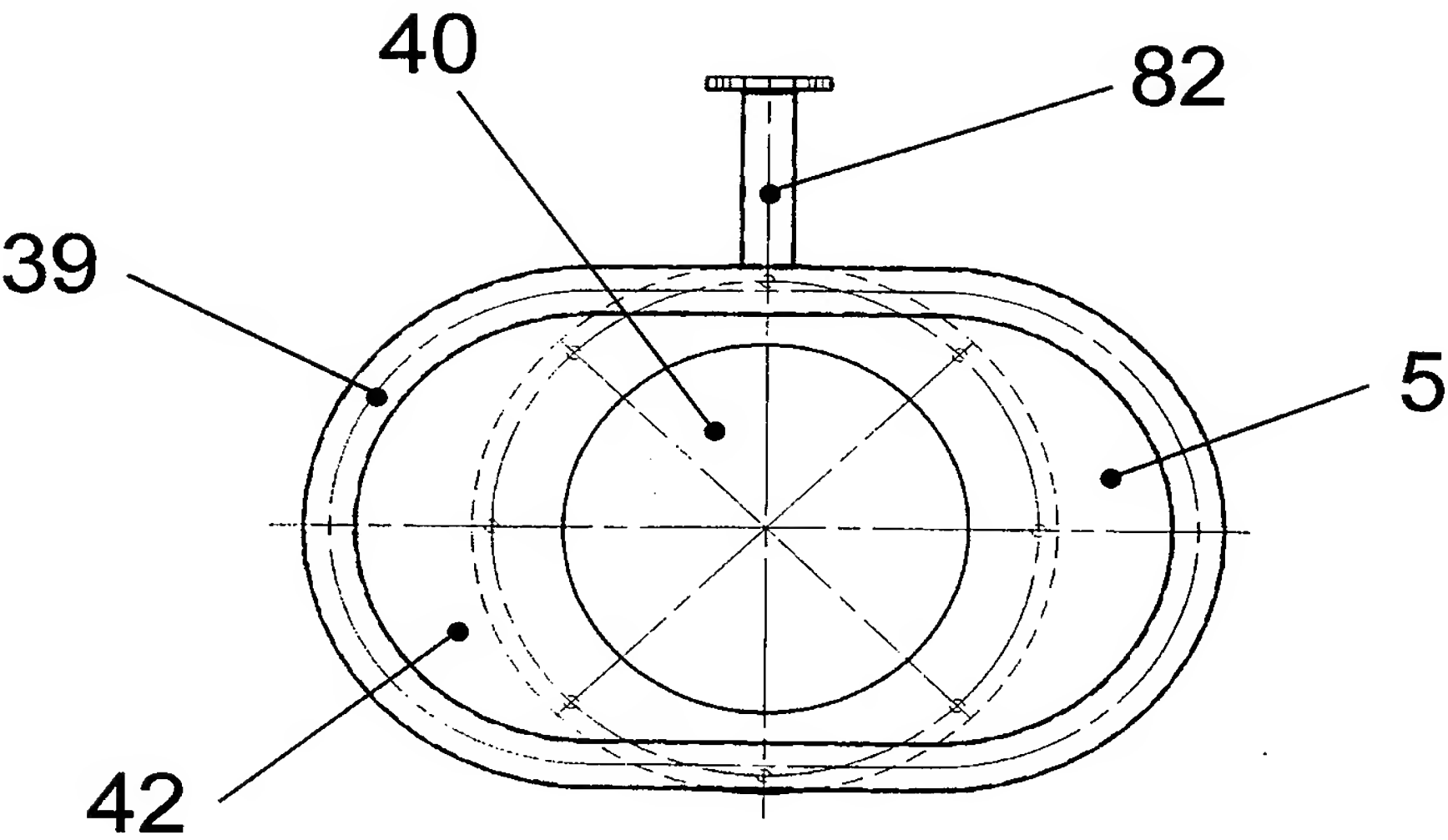


Fig. 3

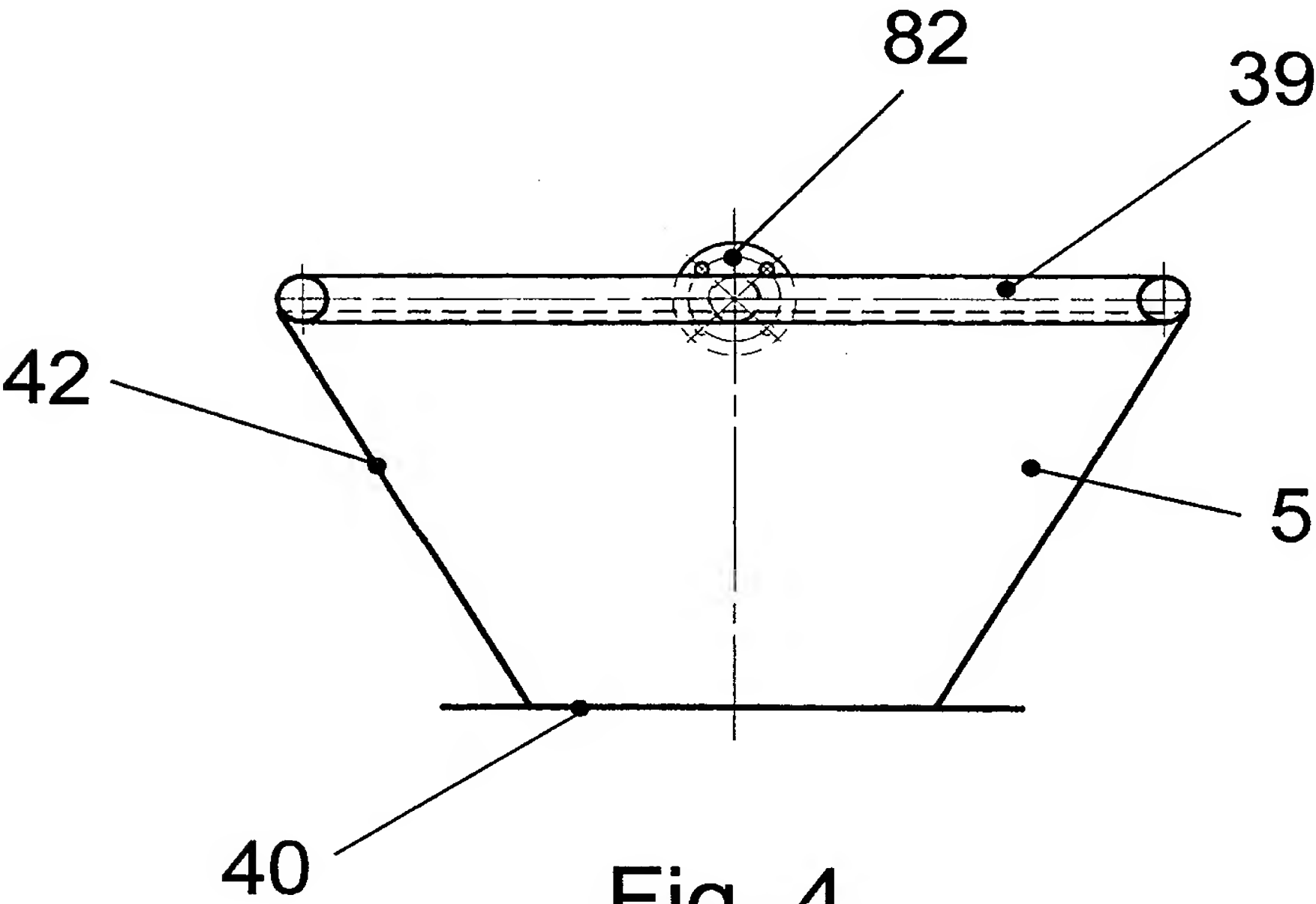
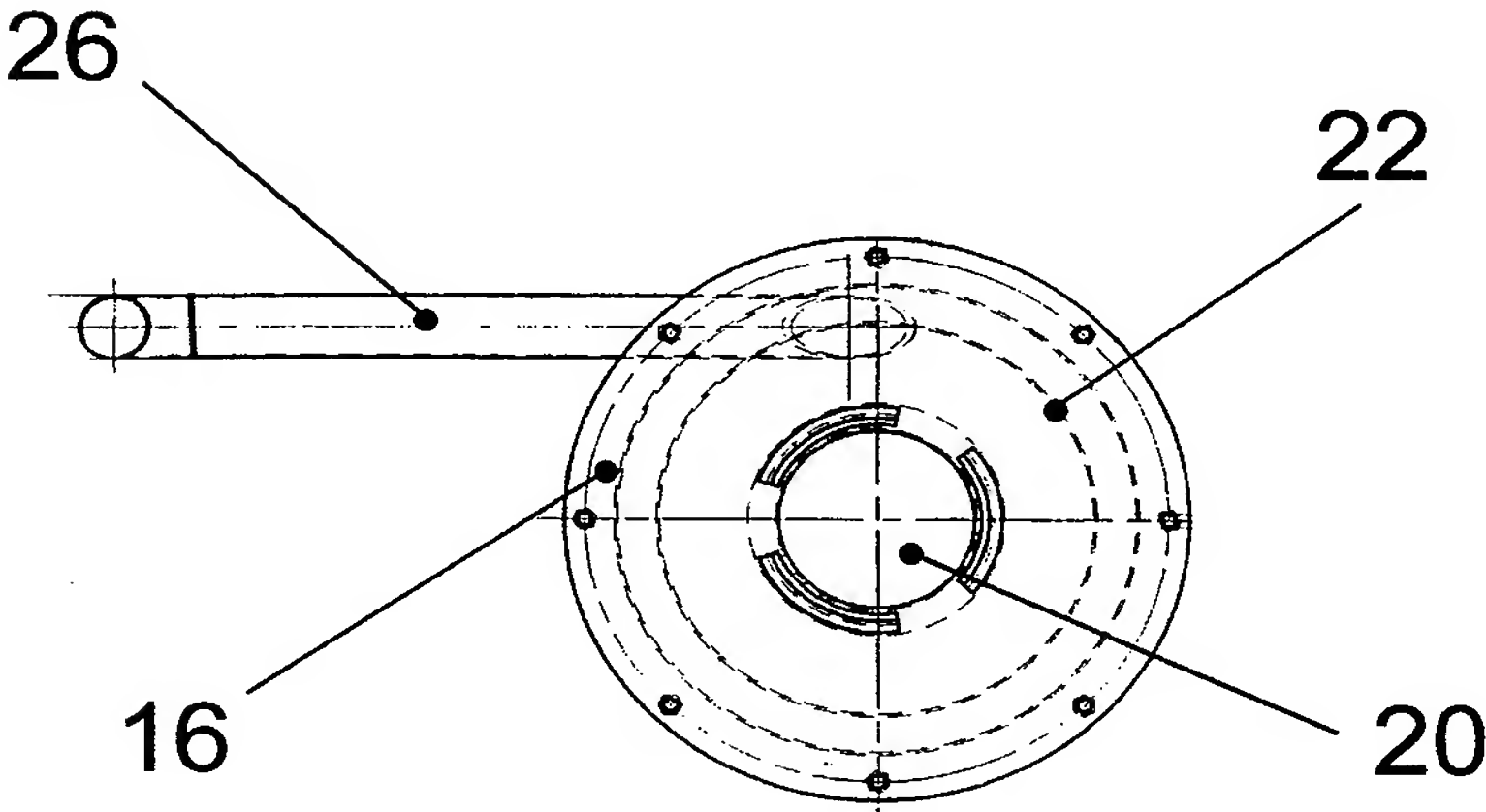
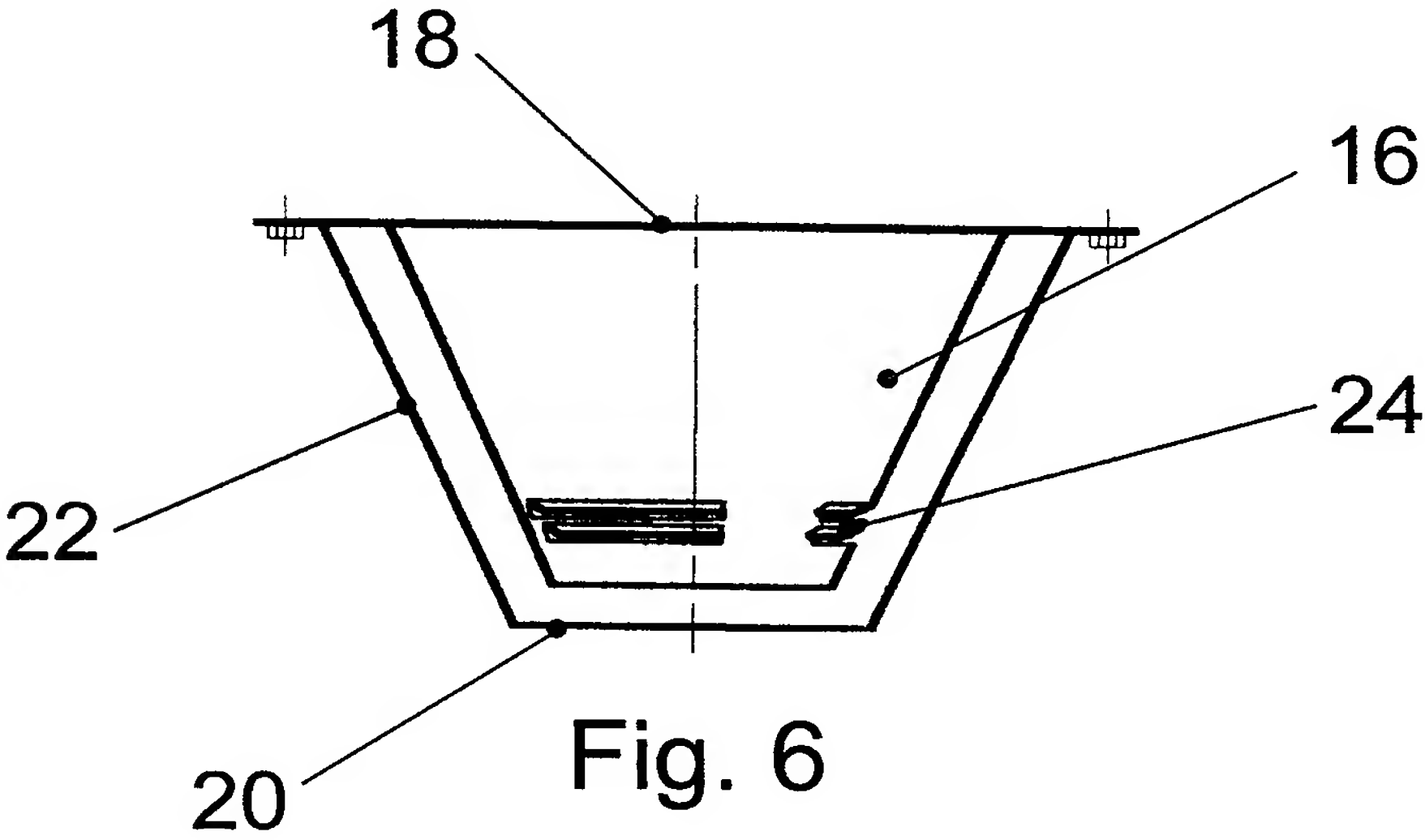
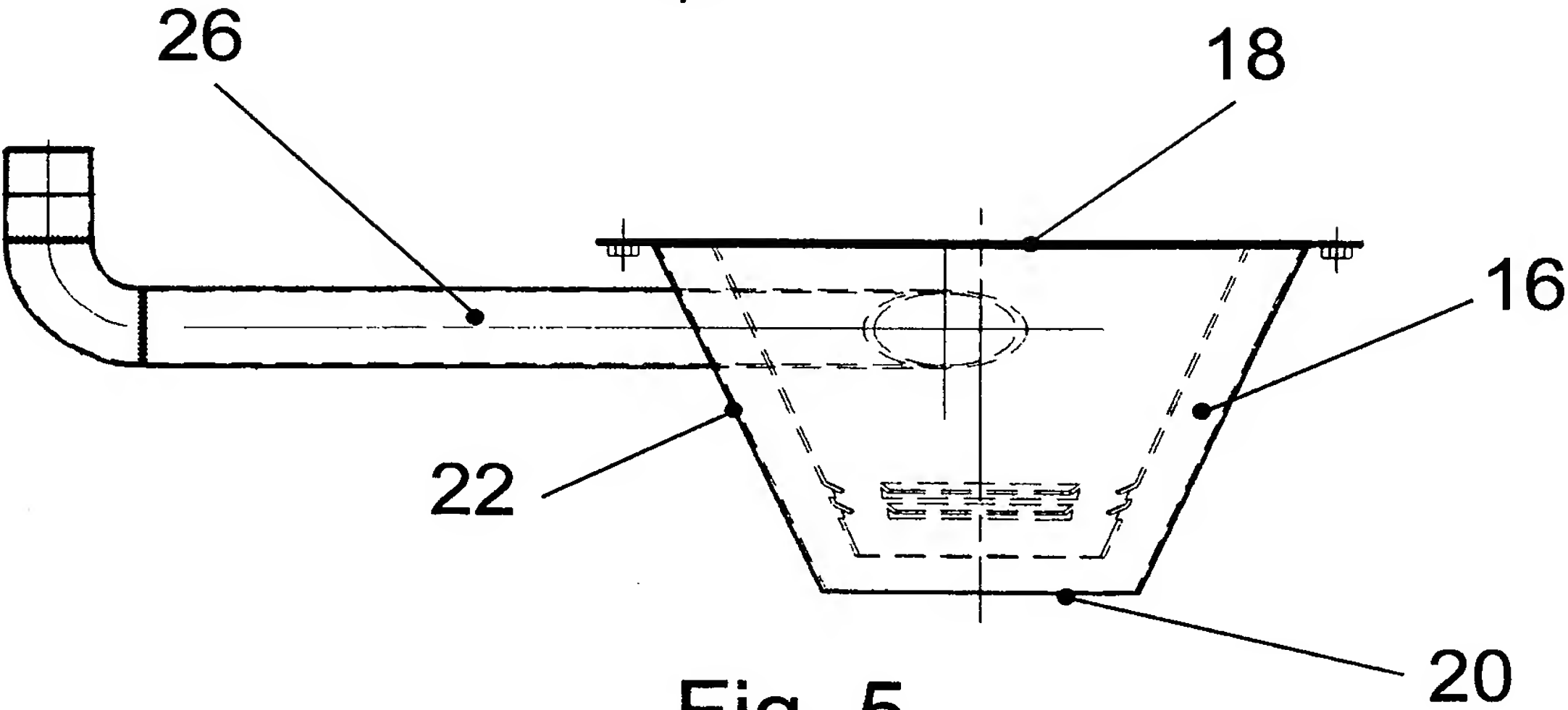


Fig. 4



# INTERNATIONAL SEARCH REPORT

Inter. Application No  
PCT/IT 99/00348

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 B01F5/00 D06B23/20

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
IPC 7 B01F D06B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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Y	the whole document	5, 8-15
Y	GB 1 027 846 A (KAISER ALUMINIUM & CHEMICAL CORPORATION) 27 April 1966 (1966-04-27) page 5, line 55 -page 5, line 66; claims 1-4	5
Y	EP 0 419 280 A (HALLIBURTON CO) 27 March 1991 (1991-03-27) the whole document	8-15
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	-/-	

☒ Further documents are listed in the continuation of box C.

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Date of the actual completion of the international search

7 March 2000

Date of mailing of the international search report

16/03/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Labeeuw, R

# INTERNATIONAL SEARCH REPORT

Intern      nal Application No
PCT/IT 99/00348

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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**DERWENT-ACC-NO:** 2000-611602

**DERWENT-WEEK:** 200240

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**TITLE:** Preparation system for mixtures of liquid-substances used for dyeing comprises suspension device for generating swirling motion of liquid inside of which substances are suspended

**INVENTOR:** PESENTI G

**PATENT-ASSIGNEE:** PESENTI G[PESEI] , TERMOELETTRONICA SPA[TERMN]

**PRIORITY-DATA:** 1999IT-T00211 (March 19, 1999)

**PATENT-FAMILY:**

PUB-NO	PUB-DATE	LANGUAGE
WO 0056432 A1	September 28, 2000	EN
AU 200012938 A	October 9, 2000	EN
IT 1308819 B	January 11, 2002	IT

**DESIGNATED-STATES:** AE AL AU BA BB BG BR CA CN CU CZ EE  
GD GE HR HU ID IL IN IS JP KP KR LC  
LK LR LT LV MD MG MK MN MX NZ PL RO  
SD SG SI SK TR TT UA US VN YU ZA AT  
BE CH CY DE DK EA ES FI FR GB GH GM  
GR IE IT KE LS LU MC MW NL OA P T  
SD SE SL SZ TZ UG ZW

**APPLICATION-DATA:**

<b>PUB-NO</b>	<b>APPL- DESCRIPTOR</b>	<b>APPL-NO</b>	<b>APPL-DATE</b>
WO2000056432A1	N/A	1999WO- IT00348	November 2, 1999
IT 1308819B	N/A	1999IT- TO0211	March 19, 1999
AU 200012938A	Based on	2000AU- 012938	November 2, 1999

**INT-CL-CURRENT:**

<b>TYPE</b>	<b>IPC DATE</b>
CIPS	B01F3/12 20060101
CIPS	B01F5/00 20060101
CIPS	D06B23/20 20060101

**ABSTRACTED-PUB-NO:** WO 0056432 A1**BASIC-ABSTRACT:**

NOVELTY - A preparation system for mixtures of liquid-substances used for dyeing has a suspension device for receiving a supply of substances and liquid. The device generates a swirling motion of the liquid inside which the substances are suspended. It unloads the suspensions of substances in a liquid outside it by keeping its swirling motion.

DESCRIPTION - A preparation system for mixtures of liquid-substances used for dyeing comprises silos (1) for storing substances; vessel(s) (7) in which substances are dissolved in a liquid; hydraulic pipes (77, 80, 82, 84, 86, 88) for supplying hot and cold water to the vessel; and another hydraulic pipes (56, 58, 60, 64, 66, 68, 70) for sending the mixture to a

downstream distribution system. The vessel is connected through ducts and a loading funnel (5) to the silos. A suspension device is placed in the vessel downstream of the loading funnel. The device receives a supply of substances and liquid. It generates a swirling motion of the liquid inside which the substances are suspended. It unloads the suspensions of substances in a liquid outside it by keeping its swirling motion. An INDEPENDENT CLAIM is also included for a device for suspending substances.

USE - For preparing mixtures of liquid-substances used for dyeing.

ADVANTAGE - The invention produces in a simple and efficient way the perfect suspension of salt (or other substance) in water (or other liquids), thus allowing it to be easily transported to the downstream distribution system in the amount required for dyeing plant workings and without duct clogging problems. It allows an easy cleaning of the duct from the remaining salt that is present.

DESCRIPTION OF DRAWING(S) - The figure is a schematic side view of the system for preparing a mixture of liquid-substances for dyeing.

Silos (1)

Ducts (3)

Loading funnel (5)

Vessel (7)

Suspension device (16)

Inlet (18)

Outlet (20)

Flow-breaker (44)

Motored stirrer (46)

Propeller (52)

Hydraulic pipes (56, 58, 60, 64, 68, 70)

Valve (66)

Hydraulic circuit (72)

Pump (74)

Hydraulic Pipes (77, 80, 82, 84, 86, 88)

### **EQUIVALENT-ABSTRACTS:**

#### INORGANIC CHEMISTRY

Preferred Component: The substances are mostly composed of salt and the liquid is water.

In an EMBODIMENT of the device, a venturi type overturned jet pipe composed the device. An inlet (18) of the device has a cross-section that is much greater than its outlet (20). The liquid supply is activated before supplying the substances. The other hydraulic pipes perform a water recirculation to wash and clean the vessel and the ducts from the substances. They uses valve (66) to switch between the mixture sending operation and the washing and cleaning operation. A hydraulic circuit (72) that is activated by a pump (74) is included in the system. A solenoid valve (76) is adapted to rebalance the pressure of water. A motored stirrer (46) with propeller (52) is adapted to keep the mixture in a further swirling motion. A flow-breaker (44) is adapted to prevent the breakage of the pumps for swirling mixture motion.

**CHOSEN-DRAWING:** Dwg.2/7

**TITLE-TERMS:** PREPARATION SYSTEM MIXTURE LIQUID  
SUBSTANCE DYE COMPRISE SUSPENSION  
DEVICE GENERATE SWIRL MOTION

**DERWENT-CLASS:** F06

**CPI-CODES:** F03-B; F03-F01; F03-F33;

**SECONDARY-ACC-NO:**

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